

ABSTRACT

Methods are disclosed to improve the planarization of copper damascene by the steps of patterning on the copper damascene a photoresist using a reverse tone photo mask or a reverse tone photo mask of the metal lines, removing excess copper by reverse current plating or by dry or wet chemical etching, stripping the photo resist, and a subsequent chemical mechanical planarization of the copper damascene. Lastly a cap layer is applied to the planarized surface. In a variant of the disclosed method a more relaxed reverse tone photo mask of the metal lines is used, which may be more desirable for practical use. These steps provide benefits such as improved uniformity of the wafer surface, reduce the dishing of metal lines (trenches) and pads, and reduce oxide erosion.

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005260-59909760